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(54) **DEDUPLICATING MESSAGES FOR IMPROVING MESSAGE SAMPLING QUALITY**

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G06F 17/00 (2006.01)
G06F 3/06 (2006.01)

(52) **U.S. Cl.**
CPC ***G06F 3/0641*** (2013.01); *G06F 2219/00* (2013.01)

(58) **Field of Classification Search**
USPC 709/206
See application file for complete search history.

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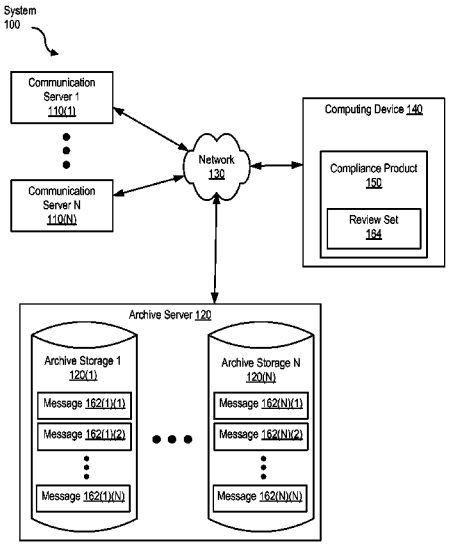
(57) **ABSTRACT**

A system and method for deduplicating messages is provided. Duplicate copies of messages are excluded from a set of deduplicated messages. The set of deduplicated messages can then be sampled to obtain a sample set usable for ensuring compliance according to a set of rules. One method for deduplicating messages involves receiving a message, determining whether the message is a duplicate copy, and adding the message to the set of deduplicated messages, if it is determined that the message is not a duplicate copy.

21 Claims, 6 Drawing Sheets



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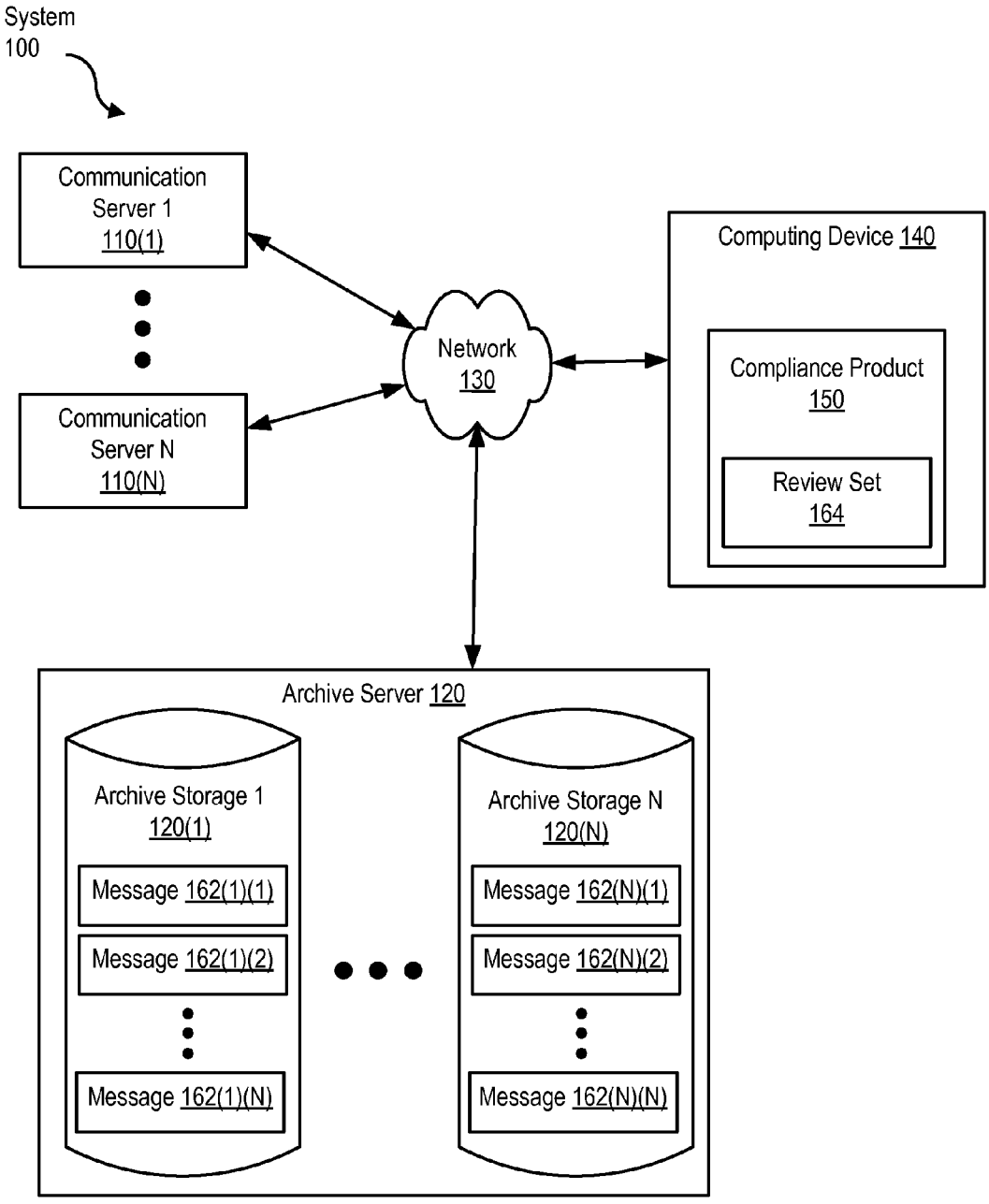
System
100
Communication
Server 1
110(1)
Communication
Server N
110(N)
Network
130
Computing Device 140
Compliance Product
150
Review Set
164
Archive Server 120
Archive Storage 1
120(1)
Message 162(1)(1)
Message 162(1)(2)
Message 162(1)(N)
Archive Storage N
120(N)
Message 162(N)(1)
Message 162(N)(2)
Message 162(N)(N)

FIG. 1

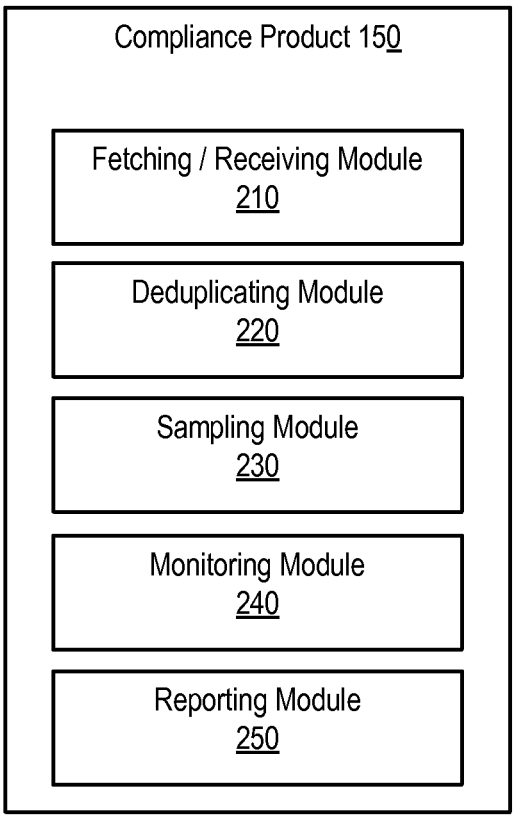
Compliance Product 150
Fetching / Receiving Module
210
Deduplicating Module
220
Sampling Module
230
Monitoring Module
240
Reporting Module
250

FIG. 2

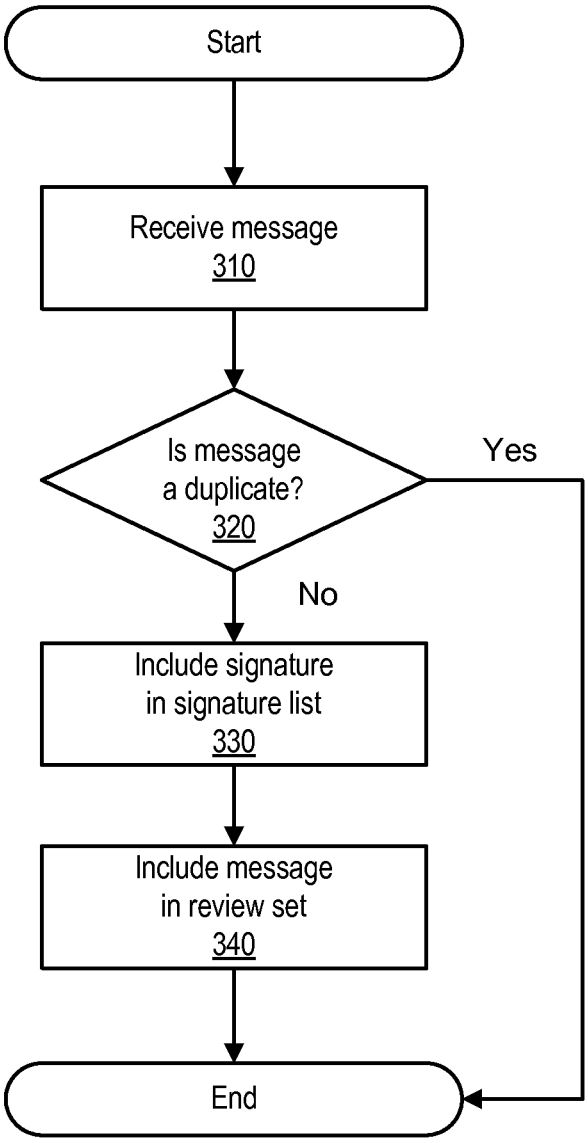
Start
Receive message
310
Is message
a duplicate?
320
Yes
No
Include signature
in signature list
330
Include message
in review set
340
End

FIG. 3

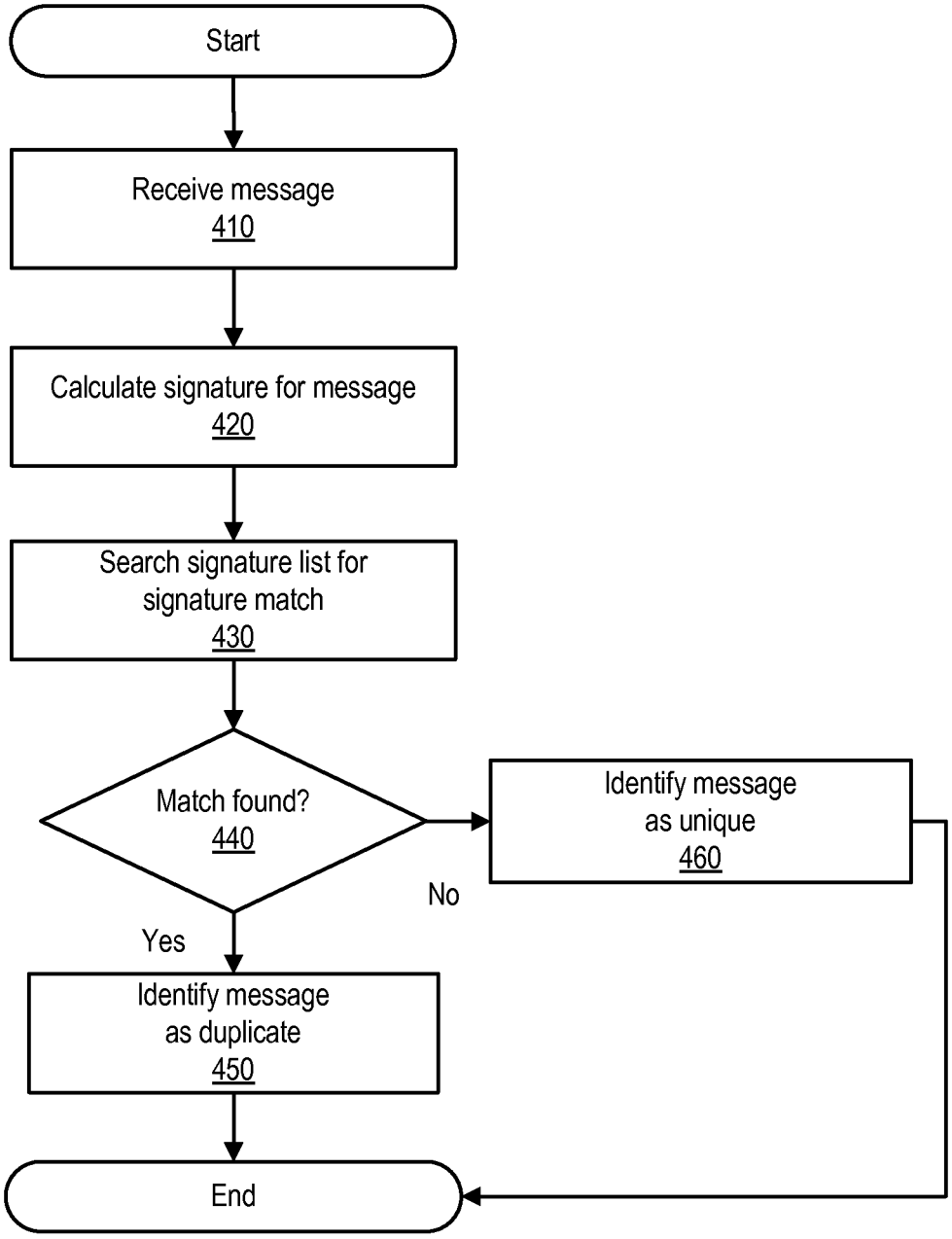
Start
Receive message
410
Calculate signature for message
420
Search signature list for
signature match
430
Match found?
440
No
Identify message
as unique
460
Yes
Identify message
as duplicate
450
End

FIG. 4

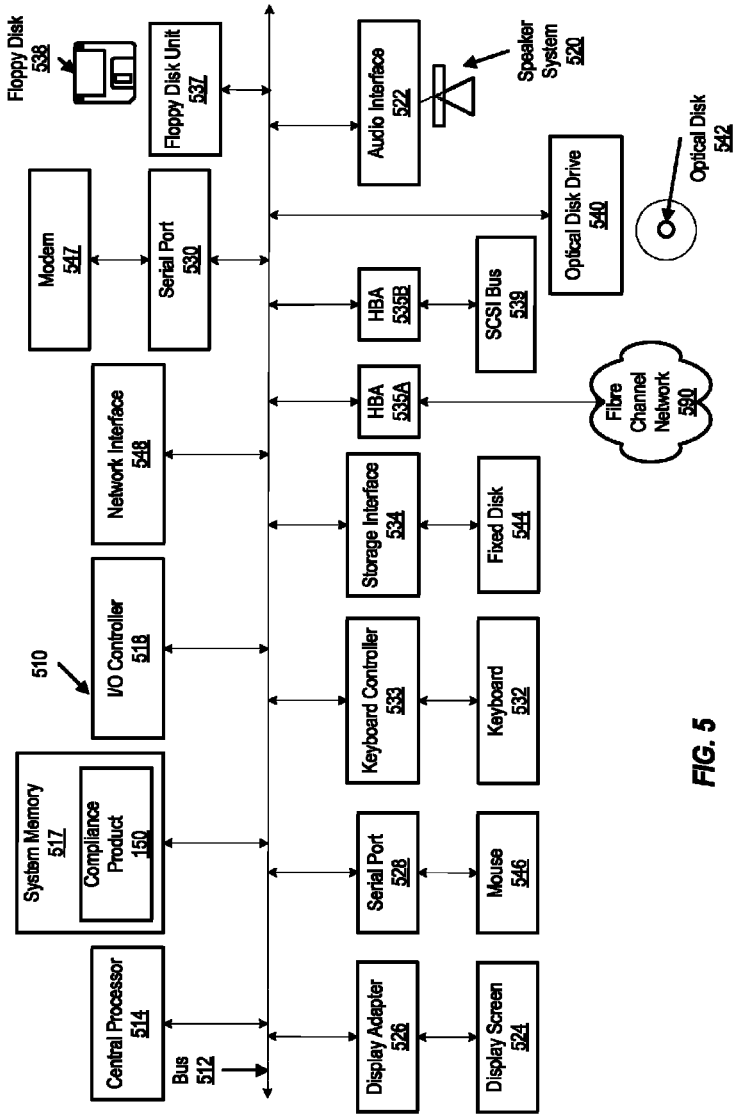
Floppy Disk 538
Floppy Disk Unit 537
Audio Interface 522
Speaker System 520
Modem 547
Serial Port 530
Optical Disk Drive 540
Optical Disk 542
HBA 535B
SCSI Bus 539
Network Interface 548
HBA 535A
Fibre Channel Network 590
510
I/O Controller 518
Storage Interface 534
Fixed Disk 544
System Memory 517
Compliance Product 150
Keyboard Controller 533
Keyboard 532
Serial Port 528
Mouse 546
Central Processor 514
Bus 512
Display Adapter 526
Display Screen 524

FIG. 5

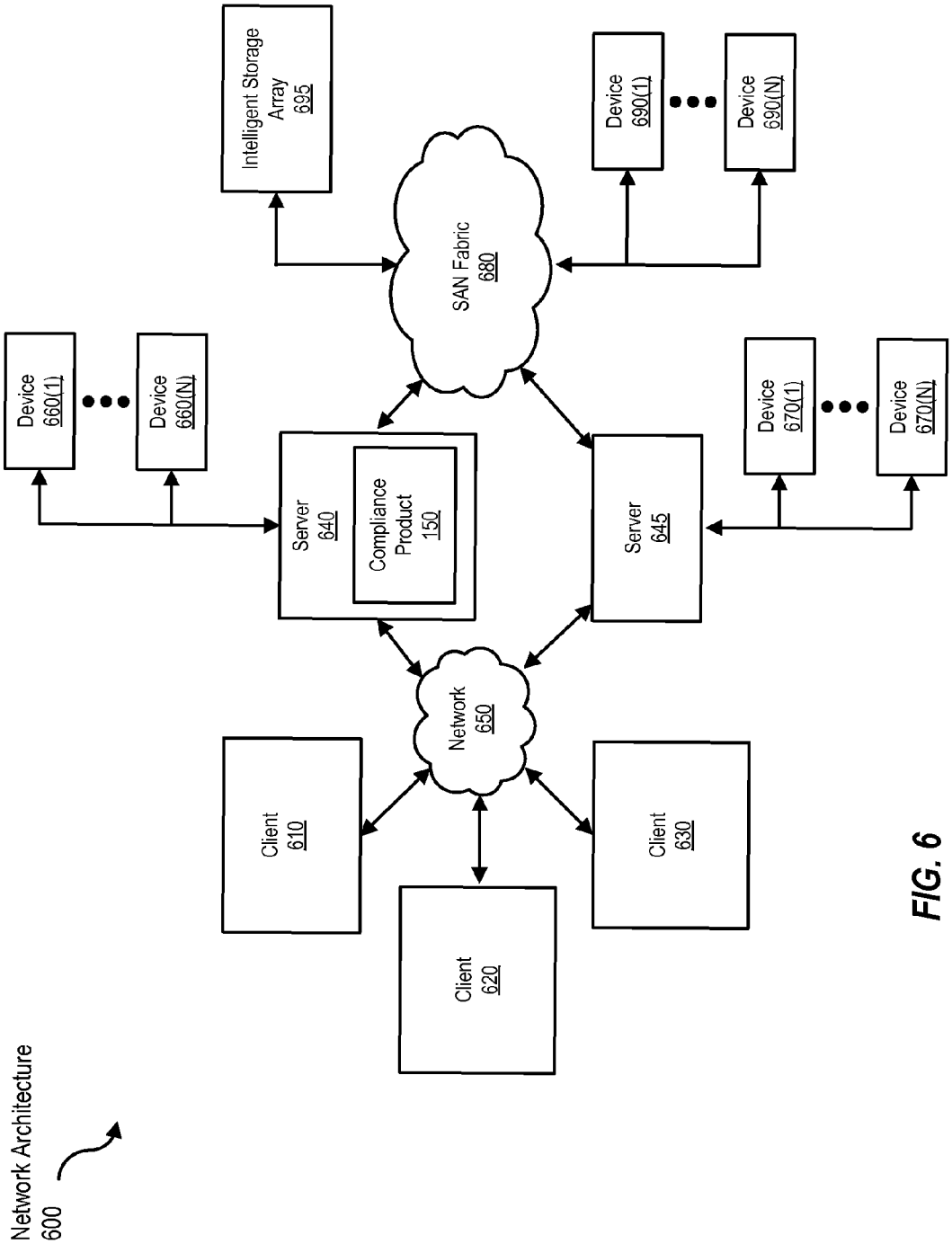
Network Architecture
600
Client
610
Client
620
Client
630
Network
650
Server
640
Compliance
Product
150
Server
645
Device
660(1)
Device
660(N)
Device
670(1)
Device
670(N)
SAN Fabric
680
Intelligent Storage
Array
695
Device
690(1)
Device
690(N)

FIG. 6

DEDUPLICATING MESSAGES FOR IMPROVING MESSAGE SAMPLING QUALITY

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to compliance monitoring, and more particularly, to removing duplicate messages from a set of messages to be reviewed by a compliance monitoring product.

2. Description of the Related Art

Organizations typically implement review procedures for reviewing electronic messages sent to and from employees of the organization. Such review procedures are performed in order to comply with regulations mandated by the federal government, particularly in the financial arena.

Sometimes, the set of electronic messages to be reviewed by an organization may include duplicate copies of a single message. For example, a set of emails to be reviewed by an organization may include duplicate copies of the same email, such as when a single email has multiple recipients. Having duplicate copies of an electronic message introduces several difficulties for an organization. These difficulties may include duplicate efforts in the review of electronic messages and an organization's failure to comply with federal regulations.

It is thus desirable to remove duplicate copies of electronic messages from a set of electronic messages to be reviewed by an organization.

SUMMARY OF THE INVENTION

Various systems and methods for deduplicating messages are disclosed. For example, one method involves receiving a message. Once a message is received, a determination is made to determine whether the message is a duplicate copy. In the event that the message is not a duplicate copy, the message is added to a set of deduplicated messages. The set of deduplicated messages is one that excludes duplicate copies of messages. The set of deduplicated messages is then sampled by a compliance product to obtain a sample set, where the sample set represents a percentage of messages taken from the set of deduplicated messages.

In one embodiment, the message is received from archival storage.

The method may also involve adding a hash value for the message to a list, if the message is not a duplicate copy. This list includes hash values for messages previously included in the set of deduplicated messages.

In one embodiment, determining whether a message is a duplicate copy begins by calculating a hash value for the message based on the contents and metadata of the message. Subsequent to calculating the hash value, the hash value is then compared against other hash values included in a hash list. If a match is found within the hash list, a determination is made that the message is a duplicate copy. However, if no match is found within the hash list, a determination is made that the message is not a duplicate copy.

In another embodiment, the method involves collecting the sample set and flagging messages from the sample set as non-compliant, if the message does not comply with a set of rules.

In yet another embodiment, the message received originates from a first mail server. In addition, a second message originating from a second mail server is also received. The second message is also added to the set of messages to be reviewed.

An example of a system can include one or more processors and memory coupled to the processors. The memory stores program instructions executable to perform a method like the one described above. Similarly, such program instructions can be stored upon a computer readable storage medium.

The foregoing is a summary and thus contains, by necessity, simplifications, generalizations and omissions of detail; consequently those skilled in the art will appreciate that the summary is illustrative only and is not intended to be in any way limiting. Other aspects, inventive features, and advantages of the present invention, as defined solely by the claims, will become apparent in the non-limiting detailed description set forth below.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention may be better understood, and its numerous objects, features and advantages made apparent to those skilled in the art by referencing the accompanying drawings.

FIG. **1** is a block diagram showing a system for removing duplicate electronic messages, according to one embodiment of the present invention.

FIG. **2** illustrates a compliance product used in the removal of duplicate electronic messages, according to one embodiment of the present invention.

FIG. **3** is a flowchart illustrating an example of a method for removing duplicate electronic messages, according to one embodiment of the present invention.

FIG. **4** is a flowchart illustrating an example of a method for identifying duplicate electronic messages, according to one embodiment of the present invention.

FIG. **5** is a block diagram of a computing system, according to one embodiment of the present invention.

FIG. **6** is a block diagram of a network system, according to one embodiment of the present invention.

While the invention is susceptible to various modifications and alternative forms, specific embodiments of the invention are provided as examples in the drawings and detailed description. It should be understood that the drawings and detailed description are not intended to limit the invention to the particular form disclosed. Instead, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION

FIG. **1** is a block diagram showing relevant components of a system for removing duplicate electronic messages from a set of messages, a process known as deduplication. As shown, system **100** includes N number of communication servers **110**, shown as communication servers **110**(**1**)-(N), an archive server **120** consisting of N number of individual archive storage components, shown as archive storage components **120**(**1**)-(N), network **130**, and computing device **140** which includes compliance product **150**. Although not shown, the system of FIG. **1** may also include additional communication servers, archive storage components, and computing devices.

Communication servers **110**(**1**)-(N) may be one or more of a mail server, a file server, or a content management server. These types of servers act as data sources within FIG. **1**. For example, mail servers may be used to send and receive electronic messages by employees of an organization. In addition,

file and content management servers may be used to provide a location for sharing files and documents with employees of an organization.

Communication servers **110**(**1**)-(N) are often times used as mail servers within an organization. Mail servers may be of the same or different types. Examples of mail servers are MICROSOFT EXCHANGE SERVER® available from Microsoft Corporation and POSTFIX® available from IBM Corporation. In addition, each mail server may be located within different offices, states, or countries. The number of mail servers maintained by an organization varies and may depend upon the size of the organization, the number of different sites or locations where the organization conducts business, and/or the physical capabilities of each mail server.

Communication servers **110**(**1**)-(N), when used as mail servers, typically include a journaling mailbox and user mailboxes. Henceforth, a journaling mailbox and user mailboxes will be referred to as a mailbox. A mailbox is used for temporarily storing and tracking electronic messages sent and received by employees. Mailboxes are typically of finite size and fill quickly. In order to maintain copies of electronic messages beyond the capacity of journaling mailboxes, archive server **120** may be used.

Archive server **120** consists of individual archive storage components **120**(**1**)-(N), which are typically storage components with a large capacity used for storing copies of some or all electronic messages sent or received by employees of an organization. This is performed by collecting copies of some or all electronic messages originating from the mail servers maintained by an organization. These electronic messages may be collected via a network, such as network **130**.

Electronic messages from mail servers, once retrieved, can then be stored permanently within archive storage components **120**(**1**)-(N) for archival purposes. As shown, archive storage components **120**(**1**)-(N) include multiple messages **162**(**1**)-(N), shown as messages **162**(**1**)(**1**)-(**1**)(N) and **162**(N)(**1**)-(N)(N). Organizations typically employ this type of archival system for backup purposes and to demonstrate routine collection of messages.

In FIG. **1**, archive storage components **120**(**1**)-(N) are used to store copies of electronic messages originating from communication servers **110**(**1**)-(N). In the event that additional communication servers existed or were added to system **100**, archive storage components **120**(**1**)-(N) could also serve to store copies of electronic messages originating from those communication servers as well. Alternatively, electronic messages originating from additional communication servers may also be stored within additional archive storage components, not shown.

Computing device **140** includes compliance product **150**. Compliance product **150** is employed by organizations to receive/fetch, archive, monitor, sample, report, and flag electronic messages received and sent by employees of the organization. In order to do so, compliance product **150** maintains a review set **164**, which represents a collection of messages received from archive server **120** and/or communication servers **110**.

For example, review set **164** may store all messages received by archive server **120** within a given time period, such as in one day, one week, etc. Messages within review set **164** are a collection of some or all messages received from archive server **120** and/or communication servers **110** and thus may include duplicate copies of the same message. This occurs, for example, when a single sender sends a message to multiple recipients thereby creating multiple copies of the same message and storing all copies within review set **164**.

The functionality of compliance product **150** enables organizations to comply with federal regulations regarding the review of electronic messages. For example, compliance product **150** can be used to satisfy the requirements of Financial Industry Regulatory Authority, Inc. (FINRA), which regulates securities firms in the United States.

As an example, FINRA requires that organizations establish products and defensible processes for archiving, sampling, and supervising electronic communications. Also, FINRA requires that organizations implement a compliance department and/or process and have a set percentage of electronic communications sampled and reviewed on a daily basis for potential wrongdoings. In the event that organizations fail to meet such regulations, organizations may be faced with stiff penalties in the form of fines and legal action.

In order to satisfy federal regulations, organizations strive to review a percentage of all electronic messages exchanged by employees of the organization within a given time frame and to do so in good faith. This means that the number of electronic messages reviewed by the organization should be enough to meet the required percentage set by federal regulations and should only include unique copies of electronic messages, i.e., no duplicate copies.

A problem that arises in the messaging and archival process is that duplicate copies are included in the set of electronic messages from which to sample for compliance purposes, e.g., review set **164**. This is because whenever an electronic message is composed by one sender and intended for various recipients, several copies of the same electronic message (including the same content but allowing for different address information) are made and stored within archive server **120** or maintained within communication servers **110**. Thus, when electronic messages are collected by compliance product **150**, there could potentially be duplicate copies of at least some of the electronic messages in review set **164**.

Taking a sample of electronic messages from a set of electronic messages that includes duplicate copies is undesirable for a number of reasons. For example, duplicate copies of electronic messages count against the total number of electronic messages from which to sample and doing so would result in failing to meet the required sample percentage mandated by federal regulations. Furthermore, every duplicate electronic message in a sample set could mean that another unique electronic message that contains possible wrongdoing would be missed during the sampling process. This could result in an organization being non-compliant with federal regulations and incur steep fines.

It is thus desirable to remove all (or at least most) of the duplicate copies of electronic messages from a set of electronic messages to be reviewed prior to performing a sampling process. A sampling process can then be performed using nearly all unique copies of electronic messages. Typically, the percentage of electronic messages needed to satisfy sampling requirements is defined by federal regulations.

Once a sample of electronic messages is identified (here, a sample is one in which duplicate messages have been removed or at least reduced in number), these electronic messages may then be reviewed for compliance purposes. This review process may be performed by employees of the organization. The review process is typically performed to ensure that electronic communications sent and received by employees of the organization do not indicate potential illegal or unethical actions being taken by its employees, or performed as otherwise specified by an applicable regulation.

Compliance product **150** is thus used to receive/fetch, archive, monitor, sample, report, and flag electronic messages sent and received by employees of an organization. This

functionality is performed using various modules within compliance product **150**, as shown in FIG. **2**.

FIG. **2** illustrates a compliance product **150** used for removing duplicate electronic messages, according to one embodiment of the present invention. Compliance product **150** includes a fetching/receiving module **210**, a deduplicating module **220**, a sampling module **230**, a monitoring module **240**, and a reporting module **250**.

Fetching/receiving module **210** fetches and/or receives copies of electronic messages that have been sent or received by employees of an organization. Typically, an organization has mail servers from which electronic messages originate. These electronic messages are copied and sent to storage for archiving. As each electronic message is sent over for archiving, a copy of each electronic message is sent to compliance product **150** via fetching/receiving module **210**. Alternatively, a copy of the electronic message can also be fetched by fetching/receiving module **210**, either from an archive server or from a mail server, in response to a request for new electronic messages by compliance product **150**. This process can be repeated over time.

In some cases, only portions of an electronic message may be fetched or received by fetching/receiving module **210**. For example, fetching/receiving module **210** may fetch or retrieve only pertinent metadata or content of an electronic message, rather than fetching or receiving all metadata and content of an electronic message.

Once copies of electronic messages are fetched and/or received, duplicate copies of electronic messages are removed by deduplicating module **220**. Deduplicating module **220** calculates a signature for each electronic message. A signature for an electronic message is typically based on some or all of the attributes of an electronic message, such as the contents and/or metadata of the electronic message. A signature can be calculated, for example, by applying a hashing algorithm to some or all of the contents of an electronic message. Other techniques, such as applying a checksum algorithm to each message, can also be used to generate message signatures. Alternatively, a signature corresponding to an electronic message can be received by deduplicating module **220** from an archival server or mail server.

In either case, a signature corresponding to an electronic message is identified and used by deduplicating module **220** to determine if an electronic message is a duplicate copy of another electronic message. Electronic messages that are duplicate copies of another electronic message typically have the same signature. Thus, by comparing signatures corresponding to an electronic message, duplicate copies of electronic messages can be identified.

Typically, deduplicating module **220** maintains a signature list that identifies unique electronic messages along with their corresponding signatures. When examining electronic messages, a signature corresponding to an electronic message is identified (either by calculating the signature or by retrieving a signature calculated by another component within the system) and compared against the signatures within the signature list. If the signature list already contains an entry for the same signature as the one calculated for the electronic message under examination, the electronic message is considered a duplicate copy and therefore not included within a set of unique electronic messages, i.e., the review set from which to sample. In the event that the signature list does not contain an entry for the same signature as the one calculated for the electronic message under examination, the electronic message under examination is not considered a duplicate copy. In this case, the electronic message is added to a review set from which to sample and the signature is added to the signature list maintained by deduplicating module **230**. This determination is performed for all electronic messages fetched and/or received from an archive server or mail server.

Once duplicate copies of electronic messages have been removed, deduplicating module **220** can store the resulting set of electronic messages as the review set from which to sample. This resulting set of electronic messages can then be used by sampling module **230** to perform the necessary sampling.

Sampling module **230** retrieves a certain percentage of electronic messages from the set of electronic messages maintained by deduplicating module **220**. The percentage of electronic messages varies by organization and typically equals the percentage mandated by federal rules and regulations.

Once a certain percentage of electronic messages are identified, this set of electronic messages is designated as a sample set. In addition, any electronic messages that have been flagged as possibly problematic by compliance product **150** may also be added to the sample set.

Detailed review of the contents of electronic messages within the sample set can then be performed to ensure an organization complies with federal rules and regulations using monitoring module **240**. Monitoring module **240** has configuration settings to define the criteria used when monitoring electronic messages. These configuration settings may be defined by an organization as desired. For example, an organization using monitoring module **240** can configure the settings to specify a list of senders or recipients which are of interest to an organization and from which electronic messages should be flagged for review.

Using monitoring module **240**, copies of electronic messages can be flagged or tagged as potential problems. This might occur when electronic messages are sent to particular senders or recipients or include certain words or phrases. This flagging or tagging process is typically performed by individuals within the organization whose job it is to review electronic messages and who possess special skills.

Reporting module **250** reports information regarding the deduplication and monitoring process performed by compliance product **150**. This information might include statistical information about the number of electronic messages reviewed, the number of duplicate electronic messages removed from a set, and the number of electronic messages tagged as problematic. The information reported may also explain the outcome of any reviews performed by individuals within the organization.

Reports generated by reporting module **250** may be stored within compliance product **150**. In addition, these reports may also be converted prior to storing, such as into a document in a MICROSOFT WORD® or MICROSOFT EXCEL® format, available from MICROSOFT® Corporation.

FIG. **3** is a flowchart illustrating an example method for removing duplicate electronic messages, according to one embodiment of the present invention. The method begins at **310** when an electronic message or relevant portions of an electronic message are received by a compliance product. An electronic message or relevant portions of an electronic message can be received or fetched from a mail server or archive server.

At **320**, a determination is made as to whether the electronic message is a duplicate copy of another electronic message. Details as to how this determination is made can be seen in FIG. **4**. If the electronic message is determined to be a

duplicate copy of another electronic message, the method can either end or be repeated for processing additional electronic messages.

Alternatively, if the electronic message is determined to be unique or not a duplicate of another electronic message, a signature corresponding to the electronic message is included in a signature list, as in **330**. In addition, the electronic message is added to a unique set of messages to be reviewed, as in **340**. At this point, the method can either end or be repeated for processing additional messages.

FIG. **4** is a flowchart illustrating an example method for determining whether electronic messages are duplicates, according to one embodiment of the present invention. The method begins at **410** where an electronic message or relevant portions of an electronic message are received.

At **420**, a signature is calculated for the received message or the received portions of an electronic message. A signature is typically calculated based on the contents and/or metadata of an electronic message and will produce a value that is unique to an electronic message. Thus, duplicate copies of an electronic message will produce equal signatures.

Once a signature for an electronic message is calculated, a search is performed within a signature list as in **430**. The signature list is a list of signatures for unique electronic messages within a set of electronic messages to be sampled from. Therefore, the search performed in **430** entails comparing the calculated signature for an electronic message against signatures contained within a signature list. This comparison is performed in order to determine if there is a match between signatures, as seen in **440**.

If the signature calculated in **420** is found within a signature list, the electronic message is identified as a duplicate, as in **450**. Otherwise, if no match is found within the signature list, the electronic message is identified as unique, as in **460**. At this point, the method ends or can be repeated for processing additional electronic messages.

FIG. **5** is a block diagram of a computing system **510** suitable for implementing the deduplication of messages as described above. Computer system **510** includes a bus **512** which interconnects major subsystems of computer system **510**, such as a central processor **514**, a system memory **517** (typically RAM, but which may also include ROM, flash RAM, or the like, and which may also include software implementing a compliance product **150** like that shown in FIG. **1**), an input/output controller **518**, an external audio device, such as a speaker system **520** via an audio output interface **522**, an external device, such as a display screen **524** via display adapter **526**, serial ports **528** and **530**, a keyboard **532** (interfaced with a keyboard controller **533**), a storage interface **534**, a floppy disk unit **537** operative to receive a floppy disk **538**, a host bus adapter (HBA) interface card **535**A operative to connect with a Fibre Channel network **590**, a host bus adapter (HBA) interface card **535**B operative to connect to a SCSI bus **539**, and an optical disk drive **540** operative to receive an optical disk **542**. Also included are a mouse **546** (or other point-and-click device, coupled to bus **512** via serial port **528**), a modem **547** (coupled to bus **512** via serial port **530**), and a network interface **548** (coupled directly to bus **512**).

Bus **512** allows data communication between central processor **514** and system memory **517**, which may include read-only memory (ROM) or flash memory (neither shown), and random access memory (RAM) (not shown), as previously noted. The RAM is generally the main memory into which the operating system and application programs are loaded. The ROM or flash memory can contain, among other code, the Basic Input-Output system (BIOS) which controls basic hardware operation such as the interaction with peripheral components. Applications resident with computer system **510** are generally stored on and accessed via a computer-readable medium, such as a hard disk drive (e.g., fixed disk **544**), an optical drive (e.g., optical disk drive **540**), a floppy disk unit **537**, or other storage medium. Additionally, applications can be in the form of electronic signals modulated in accordance with the application and data communication technology when accessed via modem **547** or network interface **548**.

Storage interface **534**, as with the other storage interfaces of computer system **510**, can connect to a standard computer-readable medium for storage and/or retrieval of information, such as a fixed disk drive **544**. Fixed disk drive **544** may be a part of computer system **510** or may be separate and accessed through other interface systems. Modem **547** may provide a direct connection to a remote server via a telephone link or to the Internet via an internet service provider (ISP). Network interface **548** may provide a direct connection to a remote server via a direct network link to the Internet via a POP (point of presence). Network interface **548** may provide such connection using wireless techniques, including digital cellular telephone connection, Cellular Digital Packet Data (CDPD) connection, digital satellite data connection or the like.

Many other devices or subsystems (not shown) may be connected in a similar manner (e.g., document scanners, digital cameras, and so on). Conversely, all of the devices shown in FIG. **5** need not be present to practice the present invention. The devices and subsystems can be interconnected in different ways from that shown in FIG. **5**. The operation of a computer system is readily known in the art and is not discussed in detail in this application. Code to implement the present invention can be stored in computer-readable storage media such as one or more of system memory **517**, fixed disk **544**, optical disk **542**, or floppy disk **538**. The operating system provided on computer system **510** may be MS-DOS®, MS-WINDOWS®, OS/2®, UNIX®, LINUX®, or another known operating system.

Moreover, regarding the signals described herein, those skilled in the art will recognize that a signal can be directly transmitted from a first block to a second block, or a signal can be modified (e.g., amplified, attenuated, delayed, latched, buffered, inverted, filtered, or otherwise modified) between the blocks. Although the signals of the above described embodiment are characterized as transmitted from one block to the next, other embodiments of the present invention may include modified signals in place of such directly transmitted signals as long as the informational and/or functional aspect of the signal is transmitted between blocks. To some extent, a signal input at a second block can be conceptualized as a second signal derived from a first signal output from a first block due to physical limitations of the circuitry involved (e.g., there will inevitably be some attenuation and delay). Therefore, as used herein, a second signal derived from a first signal includes the first signal or any modifications to the first signal, whether due to circuit limitations or due to passage through other circuit elements which do not change the informational and/or final functional aspect of the first signal.

FIG. **6** is a block diagram of a network architecture **600** in which client systems **610**, **620**, and **630** and servers **640** and **645** may be coupled to a network **650**. Client systems **610**, **620**, and **630** generally represent any type or form of computing device or system, such as computing system **510** in FIG. **5**.

Similarly, servers **640** and **645** generally represent computing devices or systems, such as application servers or database servers, configured to provide various database ser-

vices and/or run certain software applications. Network **650** generally represents any telecommunication or computer network including, for example, an intranet, a wide area network (WAN), a local area network (LAN), a personal area network (PAN), or the Internet. In one example, client systems **610**, **620**, and/or **630** and/or servers **640** and/or **645** may include a compliance product **150** as shown in FIGS. **1** and **5**.

As illustrated in FIG. **6**, one or more storage devices **660**(**1**)-(N) may be directly attached to server **640**. Similarly, one or more storage devices **670**(**1**)-(N) may be directly attached to server **645**. Storage devices **660**(**1**)-(N) and storage devices **670**(**1**)-(N) generally represent any type or form of storage device or medium capable of storing data and/or other computer-readable instructions. In certain embodiments, storage devices **660**(**1**)-(N) and storage devices **670**(**1**)-(N) may represent network-attached storage (NAS) devices configured to communicate with servers **640** and **645** using various protocols, such as Network File System (NFS), Server Message Block (SMB), or Common Internet File System (CIFS).

Servers **640** and **645** may also be connected to a storage area network (SAN) fabric **680**. SAN fabric **680** generally represents any type or form of computer network or architecture capable of facilitating communication between multiple storage devices. SAN fabric **680** may facilitate communication between servers **640** and **645** and a plurality of storage devices **690**(**1**)-(N) and/or an intelligent storage array **695**. SAN fabric **680** may also facilitate, via network **650** and servers **640** and **645**, communication between client systems **610**, **620**, and **630** and storage devices **690**(**1**)-(N) and/or intelligent storage array **695** in such a manner that devices **690**(**1**)-(N) and array **695** appear as locally attached devices to client systems **610**, **620**, and **630**. As with storage devices **660**(**1**)-(N) and storage devices **670**(**1**)-(N), storage devices **690**(**1**)-(N) and intelligent storage array **695** generally represent any type or form of storage device or medium capable of storing data and/or other computer-readable instructions.

In certain embodiments, and with reference to computing system **510** of FIG. **5**, a communication interface may be used to provide connectivity between each client system **610**, **620**, and **630** and network **650**. Client systems **610**, **620**, and **630** may be able to access information on server **640** or **645** using, for example, a web browser or other client software. Such software may allow client systems **610**, **620**, and **630** to access data hosted by server **640**, server **645**, storage devices **660**(**1**)-(N), storage devices **670**(**1**)-(N), storage devices **690**(**1**)-(N), or intelligent storage array **695**. Although FIG. **6** depicts the use of a network (such as the Internet) for exchanging data, the embodiments described and/or illustrated herein are not limited to the Internet or any particular network-based environment.

In at least one embodiment, all or a portion of one or more of the embodiments disclosed herein may be encoded as a computer program and loaded onto and executed by server **640**, server **645**, storage devices **660**(**1**)-(N), storage devices **670**(**1**)-(N), storage devices **690**(**1**)-(N), intelligent storage array **695**, or any combination thereof. All or a portion of one or more of the embodiments disclosed herein may also be encoded as a computer program, stored in server **640**, run by server **645**, and distributed to client systems **610**, **620**, and **630** over network **650**.

In some examples, all or a portion of the computing devices in FIGS. **1**, **2**, **5**, and **6** may represent portions of a cloud-computing or network-based environment. Cloud-computing environments may provide various services and applications via the Internet. These cloud-based services (e.g., software as a service, platform as a service, infrastructure as a service, etc.) may be accessible through a web browser or other remote interface. Various functions described herein may be provided through a remote desktop environment or any other cloud-based computing environment.

In addition, one or more of the components described herein may transform data, physical devices, and/or representations of physical devices from one form to another. For example, a compliance product **150** in FIG. **1** may transform messages received into signatures and then use those signatures to transform a set of messages from a set that includes duplicate messages into a set with a reduced number of (or even no) duplicate messages.

Although the present invention has been described in connection with several embodiments, the invention is not intended to be limited to the specific forms set forth herein. On the contrary, it is intended to cover such alternatives, modifications, and equivalents as can be reasonably included within the scope of the invention as defined by the appended claims.

What is claimed is:

1. A method comprising:

receiving a first message, wherein
- the first message is received by a computing device, and
- the computing device implements a compliance product;

storing the first message at the computing device, wherein
- the first message is stored as part of a review set, and
- the review set includes duplicate copies of messages;

determining if the first message is a duplicate copy of any other message in the review set;

if the first message is not a duplicate copy, adding the first message to a set of deduplicated messages, wherein
- the determining and the adding are performed by the compliance product, and
- the set of deduplicated messages excludes the duplicate copies of messages from the review set;

if the first message is a duplicate copy, excluding the first message from the set of deduplicated messages;

sampling the set of deduplicated messages, wherein
- the sampling is performed by the compliance product,
- the sampling results in a sample set comprising
  - a first subset of messages that are each associated with a unique hash value, and
  - a second subset of messages that have been flagged as potentially problematic, and
- the sample set represents a percentage of all messages in the set of deduplicated messages within a given time frame, wherein
  - the percentage is determined by a set of federal regulations regarding review of electronic messages, and
  - the federal regulations are applicable to the all messages in the set of deduplicated messages; and

determining whether each message in the sample set complies with the set of federal regulations.

2. The method of claim **1**, further comprising:

if the first message is not a duplicate copy, adding a hash value for the first message to a list, wherein
- the list comprises hash values for messages previously included in the set of deduplicated messages.

3. The method of claim **1**, wherein the determining if the first message is a duplicate copy further comprises:

calculating a hash value for the first message, wherein
- the hash value is calculated based on contents and metadata of the first message;

comparing the hash value of the first message with other hash values for other messages included in a hash list;

if a match is found for the hash value of the first message, determining that the first message is a duplicate copy; and

if no match is found for the hash value of the first message, determining that the first message is not a duplicate copy.

4. The method of claim **1**, further comprising:

collecting the sample set; and

if the each message in the sample set does not comply with the set of federal regulations, flagging the each message as potentially non-compliant.

5. The method of claim **1**, further comprising:

receiving the first message from an archive server.

6. The method of claim **1**, further comprising

receiving a second message, wherein

the first message is a copy of a message originating from a first communication server, and

the second message is a copy of a message originating from a second communication server; and

adding the second message to the review set.

7. The method of claim **1**, further comprising:

adding a second message to the sample set, prior to the determining whether each message in the sample set complies with the set of federal regulations, wherein

the second message was previously identified as problematic by the compliance product.

8. The method of claim **1**, further comprising:

defining criteria for monitoring messages at the compliance product.

9. The method of claim **1**, wherein

the given time frame is defined on a daily basis.

10. A non-transitory computer readable storage medium comprising program instructions executable to:

receive a first message;

store the first message, wherein

the first message is stored as part of a review set, and

the review set includes duplicate copies of messages;

determine if the first message is a duplicate copy of any other message in the review set;

add the first message to a set of deduplicated messages, if the first message is not a duplicate copy, wherein

the set of deduplicated messages excludes the duplicate copies of messages from the review set;

exclude the first message from the set of deduplicated messages, if the first message is a duplicate copy;

sample the set of deduplicated messages, wherein

the receiving, the storing, the determining if the first message is a duplicate copy, the adding, the excluding, and the sampling are performed by a computing device,

the computing device implements a compliance product,

the sampling results in a sample set comprising

a first subset of messages that are each associated with a unique hash value, and

a second subset of messages that have been flagged as potentially problematic, and

the sample set represents a percentage of all messages in the set of deduplicated messages within a given time frame, wherein

the percentage is determined by a set of federal regulations regarding review of electronic messages, and

the federal regulations are applicable to the all messages in the set of deduplicated messages; and

determine whether each message in the sample set complies with the set of federal regulations.

11. The non-transitory computer readable storage medium of claim **10**, wherein the program instructions are further executable to:

add a hash value for the first message to a list, if the first message is not a duplicate copy, wherein

the list comprises hash values for messages previously included in the set of deduplicated messages.

12. The non-transitory computer readable storage medium of claim **10**, wherein the program instructions are further executable to:

calculate a hash value for the first message, wherein

the hash value is calculated based on contents and metadata of the first message;

compare the hash value of the first message with other hash values for other messages included in a hash list;

determine that the first message is a duplicate copy, if a match is found for the hash value of the first message; and

determine that the first message is not a duplicate copy, if no match is found for the hash value of the first message.

13. The non-transitory computer readable storage medium of claim **10**, wherein the program instructions are further executable to:

collect the sample set; and

flag the each message in the sample set as potentially non-compliant, if the each message does not comply with the set of federal regulations.

14. The non-transitory computer readable storage medium of claim **10**, wherein the program instructions are further executable to:

receive the first message from an archive server.

15. The non-transitory computer readable storage medium of claim **10**, wherein the program instructions are further executable to:

receive a second message, wherein

the first message is a copy of a message originating from a first communication server, and

the second message is a copy of a message originating from a second communication server; and

add the second message to the review set.

16. A system comprising:

one or more processors; and

memory coupled to the one or more processors, wherein

the memory stores program instructions executable by the one or more processors to:

receive a first message,

store the first message, wherein

the first message is stored as part of a review set, and

the review set includes duplicate copies of messages,

determine if the first message is a duplicate copy of any other message in the review set,

add the first message to a set of deduplicated messages, if the first message is not a duplicate copy, wherein

the set of deduplicated messages excludes the duplicate copies of messages from the review set,

exclude the first message from the set of deduplicated messages, if the first message is a duplicate copy,

sample the set of deduplicated messages, wherein

the receiving, the storing, the determining if the first message is a duplicate copy, the adding, the excluding, and the sampling are performed by a computing device,

the computing device implements a compliance product,

the sampling results in a sample set comprising

a first subset of messages that are each associated with a unique hash value, and

a second subset of messages that have been flagged as potentially problematic, and

the sample set represents a percentage of all messages in the set of deduplicated messages within a given time frame, wherein

the percentage is determined by a set of federal regulations regarding review of electronic messages, and

the federal regulations are applicable to the all messages in the set of deduplicated messages, and

determine whether each message in the sample set complies with the set of federal regulations.

17. The system of claim **16**, wherein the program instructions are further executable to:

add a hash value for the first message to a list, if the first message is not a duplicate copy, wherein

the list comprises hash values for messages previously included in the set of deduplicated messages.

18. The system of claim **16**, wherein the program instructions are further executable to:

calculate a hash value for the first message, wherein

the hash value is calculated based on contents and metadata of the first message,

compare the hash value of the first message with other hash values for other messages included in a hash list,

determine that the first message is a duplicate copy, if a match is found for the hash value of the first message, and

determine that the first message is not a duplicate copy, if no match is found for the hash value of the first message.

19. The computer readable storage medium of claim **18**, wherein the program instructions are further executable to:

collect the sample set,

and

flag the each message in the sample set as potentially non-compliant, if the each message does not comply with the set of federal regulations.

20. The computer readable storage medium of claim **18**, wherein the program instructions are further executable to:

receive the first message from an archive server.

21. The computer readable storage medium of claim **16**, wherein the program instructions are further executable to:

receive a second message, wherein

the first message is a copy of a message originating from a first communication server, and

the second message is a copy of a message originating from a second communication server, and

add the second message to the review set.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 9,164,687 B1
APPLICATION NO. : 13/006909
DATED : October 20, 2015
INVENTOR(S) : Bhatt et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Column 10
Line 52, in Claim 1, replace: "the federal" by -- the set of federal --

Column 11
Line 64, in Claim 10, replace: "the federal" by -- the set of federal --

Column 13
Line 9, in Claim 16, replace: "the federal" by -- the set of federal --

Column 14
Line 6, in Claim 19, replace: "computer readable storage medium" by -- system --
Line 13, in Claim 20, replace: "computer readable storage medium" by -- system --
Line 16, in Claim 21, replace: "computer readable storage medium" by -- system --

Signed and Sealed this
Twenty-first Day of June, 2016

Michelle K. Lee

Michelle K. Lee
Director of the United States Patent and Trademark Office